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MILITARY TOPOGRAPHY.

Recherches sur les Instruments, les Methodes et le Dessin Topographiques. By le Colonel A. Laussedat. Tome ii., part ii. Pp. 287. (Paris: Gauthier-Villars, 1903.)

THE second volume of Col. Laussedat's exhaustive work on topography, which has just been published, deals with the art of metrophotography as developed in Europe generally and in France in particular; condensing the opinions and experiments of leading men of science, and epitomising their results. Attempts to adapt the principles of natural perspective to topography in France date from the middle of the last century. French methods were adopted by Germany in 1865; Italy followed suit in 1875; and in Austria, Maurer executed a military reconnaissance of some importance (which could have been attained in no other way) in 1887. There has gradually accumulated a large amount of scientific literature in Austria dealing with this subject; and in 1889 the Swiss engineer S. Simon had made a photographic survey of Jungfrau. Russia has been busy for many years in the Trans-Caucasus and in Persia, working on similar methods to those of Switzerland, whilst Greece, Brazil and Madagascar have all contributed results of scientific value towards the development of the art. Spain has been interested since 1863, and in 1899 an "excellent ouvrage" was produced in Madrid by two engineers, Iriarte and Navarro, which seems to have been the most complete work on the subject up to the date of Laussedat.

New Zealand and Australia have not been idle; but amongst our colonies it is to Canada chiefly that we look for the most practical experiments leading to the most noteworthy results in this as in every other branch of topographic art. In the United States as early as 1886, photographic methods for rapid reconnaissance were taught at West Point; but it is to the Canadian experts, Deville and Fleurer, that we owe most of our practical knowledge. A general summary of Canadian results will be found in Wilson's useful work on topographic art.

England and English surveyors alone contribute nothing to the world's knowledge of this branch of surveying, although of all countries in the world England is probably most interested in its development. Colonel Laussedat, noting that as early as 1869 Colonel J. Baillie proposed that photography should be utilised as an aid to reconnaissance, suggests that the absence of all result may be due to the fact that its military application precluded it from publication—"il est probable que des résultats à la fois curieux et utiles ont pu être obtenus dans un ordre d'idées qui ne se prête pas à la publicité." But he is probably unaware that the preliminary art of topography is as yet undeveloped in England; and that we are still a long way from the scientific consideration of any of its more subtle branches. It is true that in India (where the knowledge of topography is an every day practical necessity) some experiments have

been made with the Bridges-Lee instrument (the phototheodolite), but there are good reasons why photography as an aid to surveying should only be applicable in exceptional cases and under exceptional conditions in that country. The ultimate practical value of metrophotography lies in the power which it places in the hands of one accomplished topographer to do the work of many. It is a financial question in the long run, but, as Col. Laussedat does not fail to point out, it is useless in the hands of an amateur. It requires a surveyor (or an artist) of exceptional ability and experience as a topographer to render it effective. Workmen of this stamp are rare anywhere and command good value for their work. In India the simpler form of topography attained by the use of the plane table (which is invariably superior in its final results to those of metrophotography when applied to ordinary country by ordinary workmen) is attained cheaply and satisfactorily; for the native labour of India is cheap, abundant, and specially adapted by nature to this form of art. Metrophotography, therefore, would probably not pay.

The practical application of metrophotography has been well exemplified by Le Bon in India, in aid of archæological research; by Legros as an explorer; by Vallot as a mountaineer (in which direction it is specially useful), and by many other Frenchmen in various ways in different parts of the world, leaving no room for doubt as to its value in exceptional circumstances, and the necessity for its continued development. But Laussedat is at some pains to quote the opinion of the Canadian expert Deville, who proves clearly the limitations of the art, and shows that photographic topography is just as much dependent on accurate preliminary triangulation as any other form of topography. He enters fully into the difficulties which beset the method, both as to the determination of scale and the representation of orographic features by contours.

A variety of new instruments designed to aid in the reduction of photographs to plan are described, and the scientific principles involved in their construction are discussed at length—such as the trirègle of Nicholson, the perspectograph of Hermann Ritter, Hanck's apparatus, and the perspecteur panoramique of Ch. von Ziegler. Some of the problems offered for the consideration of his readers are of considerable mathematical complexity. A good deal has been added to that which has already appeared in vol. i. on the subject of telephotography (which was employed with so much success by engineers during the siege of Paris), and forms a particularly fascinating chapter in this work.

A chapter on balloon and kite flying reconnaissance, with an inquiry into the nature of the instruments used and of their attachments, as well as into the principles involved in determining the scale of the resulting photograph and in the reduction of observations, is interesting; although it is difficult to believe that automatic observations taken from flying kites or balloons can be made valuable for military purposes unless applied to the illustration of positions within which two or three points have been accurately fixed

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by one of the ordinary methods of terrestrial survey. The results of the first trial in the kite flying for plan photographic purposes were published in *La Nature* by M. Batut in 1888, so that the experiment is by no means new; but we doubt if this system has ever really added any valuable results to the reconnaissance information obtained by more usual methods in time of war; and it is conceivable that only for military purposes under stringent conditions would such methods be applicable. Stereophotography is the subject which concludes Col. Laussedat's review of instruments and methods. This, indeed, forms a most useful variation on ordinary metrophotographic observations, for it is obvious that the representation of orographic features as effected by this well known process conveys a far more readable impression to the eye of the nature of the country photographed, the rise and fall of undulations, the gradation of slopes, &c., than any flat photograph can possibly convey. It is a branch of photography applied to topography which has received very considerable attention in France, and it promises to become a very valuable aid in the process of reducing landscape photographs to topographical maps in future.

Colonel Laussedat has undoubtedly written a most valuable book—one which will be a standard authority for years on the subjects which he treats so ably. Men of science and experts may not agree as to the practical utility of some of the methods discussed; but they are discussed impartially, carefully, and in almost exhaustive detail, and the reader is left to form his own conclusions. There are yet many countries in the world which are greatly in need of good topographical illustration of the natural features contained in them. There are still vast areas unmapped, if not unexplored. Thus Col. Laussedat's book appears at a most appropriate time, when the demand for topography is the first demand of the administrator, and the necessity for utilising every method which promises to effect a saving of time and expense is paramount. It should find a place in every scientific library with any pretension to completeness.

T. H. H.

NATURE STUDY AS A SCHOOL SUBJECT.

An Introduction to Nature Study. By E. Stenhouse. Pp. x + 422. (London: Macmillan and Co., Ltd., 1903.) Price 3s. 6d.

SINCE the attempt was made a year or two ago to introduce into our rural elementary schools the subject called "nature-study," really such a general introduction to the science of living things as will give the pupil a means of taking an interest in his environment, there has been a great lack of adequate books for the teacher. Several men, Dr. Armstrong, Prof. Miall, and Prof. Lloyd Morgan, for instance, have spoken about the spirit in which the work should be undertaken, nor are there wanting books which indicate the method to be followed, that of experiment and observation. But the ordinary teacher without any particular training in the subject has wanted more

systematic guidance, his previous training has been in the wrong direction, and the many text-books that have been hurried on to the market have only tended to confirm his probable original error that nature-study consisted in reading about natural objects or anything bearing on country life.

At last, however, we have a text-book of the right kind, something that we can unreservedly recommend to the teacher, both as a guide to the method he should follow and as a storehouse of instructions concerning the details of experiments within his reach. The book is avowedly written to cover section i. of the Board of Education course in general biology; it is equally well suited to the more recent syllabuses in nature-study or the elementary stage in agriculture and rural economy issued by the same department.

The book opens with a study of the growth of the plant, first describing the elementary experiments illustrating the structure and development of the seedling, then the function of leaf, stem and flower.

A little more might have been done to show how many of the experiments can be rendered quantitative, so as to yield exercises in measurement and continuous record keeping; indications also might have been given of how the teaching could be brought home to the country child by illustrations from farm or garden practice. For example, it is easy to carry out experiments in the garden on the best depths at which seeds of various sizes should be sown, on the necessity of a good seed bed, or the harm wrought by plastering seeds into wet sticky soil, all of which give practical point to the lessons derived from the experiments in class. Again, the structure of the stem finds many appropriate illustrations in the various methods of propagation by cuttings or layers, buds or grafts, the healing of wounds on a tree, knots and other common features in timber.

The discussion of plant families and orders is refreshingly free from technicalities, though here again more might be made of systematic observations from month to month of the development of characteristic structures like tubers, bulbs, corms, &c.

The animal life section gives first of all some elementary instruction about physiology and structure, taking the rabbit as a text, and then discusses briefly the characteristics of our commoner mammals. The section on birds contains a good chapter on the development of the hen's egg during incubation, followed by an account, brief but suggestive, of a few familiar birds. A chapter on the frog and its development from the egg is followed by one on insects, dealing with the structure and life-history of one or two common forms.

The scope of the book is obviously considerable, and it is by no means desirable to use it wholesale, but in the hands of an intelligent teacher who will select the sections most suitable to his conditions, practise himself in the experiments, and then get his pupils to help him to carry out numerous repetitions, who finally will add local illustrations and practical applications, the book will be of the utmost service in systematising his instruction and guiding it along the fruitful lines of experiment and research.

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